A REVIEW OF THE VARIETIES OF POLYMNIA UVEDALIA[1]

JAMES R. WELLS

More than fifty years ago three varieties of *Polymnia uvedalia* (L.) L. were described (Blake 1917). The varieties are: *uvedalia* — pedicels and inflorescence branches densely stipitate-glandular, sessile glands present; hispid-pilose hairs none or few; *floridana* — pedicels and inflorescence branches with sessile or nearly sessile glands; hispid-pilose hairs infrequent; *densipilis* — glands inconspicuous; hispid-pilose hairs frequent.

Although authors of recent manuals and floras usually have failed to treat these varieties, they were listed in a recent review of the genus (Wells 1965). Some additional comment upon their significance is perhaps justified as part of an overall effort to achieve a better understanding of this Western Hemisphere genus.

The distribution of *Polymnia uvedalia* by varieties (Fig. 1 plus Bermuda) is based upon examination of types as well as other herbarium material from BLH, F, GH, ILLS, IND, LSU, MEXU, MICH, MO, MSU, ND, NY, NCU, OS, OU, PH, SIU, SMU, TAES, TENN, TEX, US, and WIS. See Lanjouw and Stafleu (1964) for key to these abbreviations. Varieties are undetermined at sites indicated by "+", and the e. central Ill. record comes from R. P. Wunderlin (pers. comm.). In commenting upon varietal distributions, Blake (1917) noted that in the northern and eastern portion of the species range var. *uvedalia* predominates while in the west var. *densipilis* is most common. In the southern and southeastern part of the U. S. var. *floridana* is most frequently encountered. When the three varieties are mapped separately (Fig. 1) Blake's statement is substantiated but it should be noted that there is considerable overlap in ranges. Thus, varietal

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Fig. 1. Distribution of *P. uvedalia* (plus Bermuda). Varieties undetermined at sites marked "+".

distribution patterns represent only tendencies. In the field I have observed one variety growing within a few feet of another variety. The apparent absence of *P. uvedalia* from the northern portions of Ill., Ind., and Ohio is likely a result of prairie peninsular extension into those regions (Dansereau, pers. comm.). Otherwise, it seems to conform to most of the Gray's Manual range of coverage.

Although Bermuda is the only location of *Polymnia uvedalia* known to me outside the U. S., facts do not now support Blake's data (1917) on the occurrence of only var. *densipilis* on that island. Examination of Bermuda material

included specimens of all three varieties and in 1966 I collected living material of var. *floridana* there.

Results of attempts at hybridization among the varieties are listed below (Table 1). These results are in agreement

Table 1. SUMMARY OF HYBRIDIZATION ATTEMPTS

Pollen Parent	Ovule Parent	Crosses Attempted	Fruits Formed	
P. uvedalia var.			No.	Percent
floridana	*densipilis*	68	61*	90
densipilis	*floridana*	59	37	63
uvedalia	*floridana*	53	10*	19
floridana	*uvedalia*	50	38	76
densipilis	*uvedalia*	57	42	74
uvedalia	*densipilis*	95	54	57
floridana[B]	*uvedalia*	58	29	50
uvedalia	*floridana*[B]	54	23	43
floridana[B]	*floridana*	42	15*	36
floridana	*floridana*[B]	51	29	57
floridana[B]	*densipilis*	65	40	62
densipilis	*floridana*[B]	54	27	50
	TOTAL	706	405	57

* X^2 test results indicate significance at the 5% level in this reciprocal cross.

[B] Indicates Bermuda origin of var *floridana* plant.

with earlier reports (Wells 1966). The percentages of fruits formed are probably somewhat reduced due to accidental breakages of vascular connections between pistillate flowers and receptacle during emasculation. (Emasculation was carried out prior to anthesis in every cross.) The higher percentages of fruits formed in this study than formerly (Wells 1966) may reflect my increased facility in handling the material. With the exception of var. *floridana* from Bermuda the same cultures were used. Without emasculation, higher percentages of fruits are formed but self-fertilization and pseudogamy cannot be completely ruled out (Wells 1966).

In all of the 706 crosses only 4 plants were involved. Data involving var. *floridana* from Bermuda correspond to data obtained for the other two varieties from the U. S. Judging from comparative crossabilities between all varieties with var. *floridana* from Bermuda there is no apparent evidence for a distinct genetic race on this island. An unexpected reduction in fertility is indicated when var. *floridana* of U. S. origin is employed as the ovule parent. Significant differences involving this individual may arise due to chance occurrence of a genotypically unique *floridana* plant from the United States. Such events may occasionally be observed when minimal numbers of plants are involved in an experimental treatment.

Parent plants as well as their progeny had gametic counts of $n=16$ and meiotic pairing appeared normal. Only one cytological anomaly was detected and this tetraploid resulted from the cross of vars. *floridana* and *uvedalia*. Pollen stainability using analine blue in lactophenol was at least 90% in all cases.

The fruits of *Polymnia uvedalia* have thick, woody coats. Removal of at least 50% of the fruit coat prior to their placement on moist filter paper resulted in almost 100% germination. The seedlings grew rapidly under greenhouse conditions and the F_1 plants began to flower in about 70 days. Fruits matured approximately 21 days later.

Vestiture differences between vars. *densipilis* and *floridana* represent, to a great extent, a matter of degree rather than kind; therefore, phenotypic data from F_1, F_2, or backcrosses would represent at best a mere guess. Thus, Tables 2, 3, and 4 lack data showing crosses between these two varieties. It is clear from Table 1 that vars. *densipilis* and *floridana* can be crossed reciprocally. Seeds from these reciprocal crosses are viable and a total of 23 plants flowered. Peduncle vestiture appeared to be "intermediate" although this represents only a crude estimate.

Backcross data involving var. *floridana* as the ovule par-

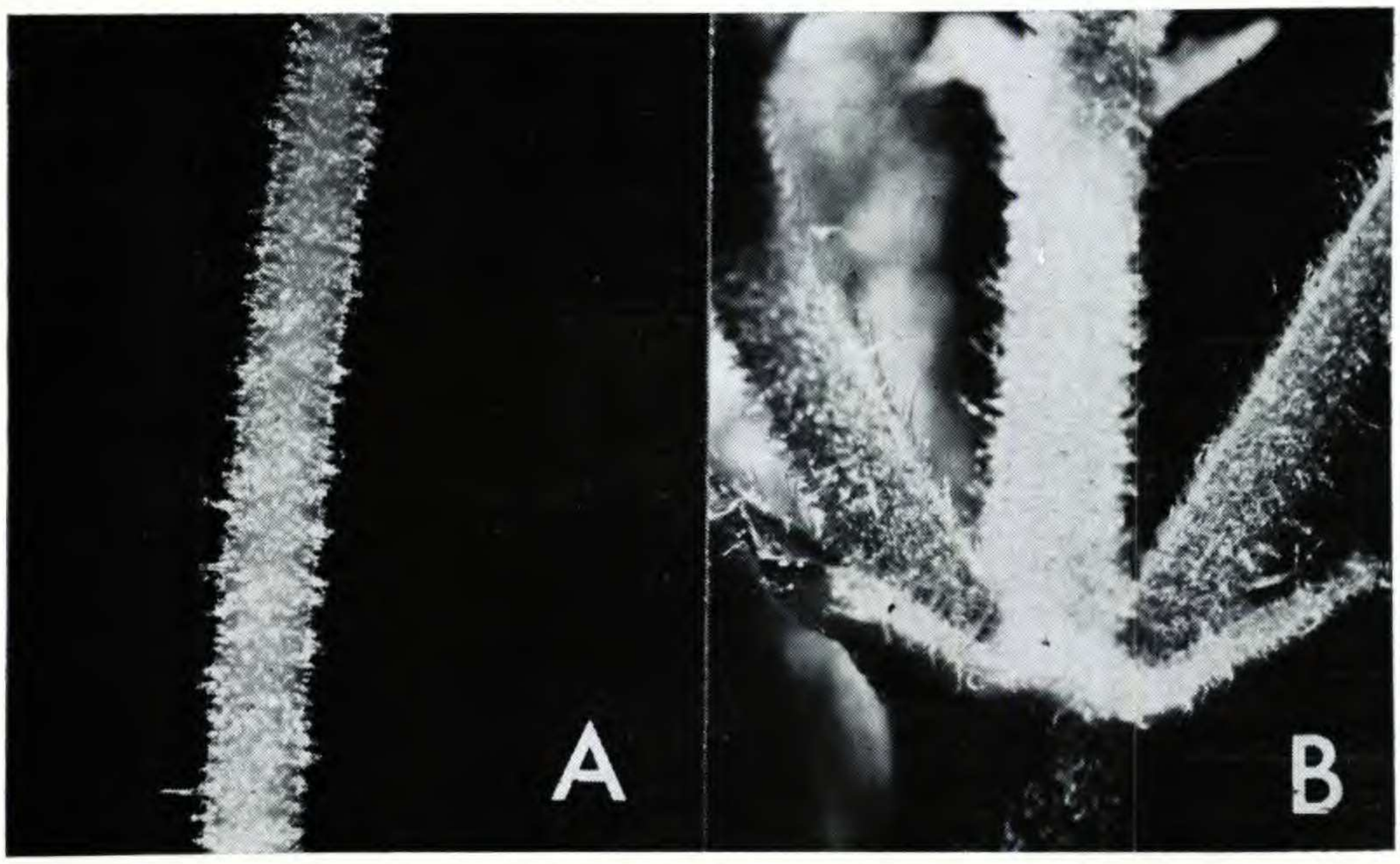
Table 2. SUMMARY OF BACKCROSSES AND CROSSES AMONG F_1 PLANTS

Pollen Parent (Variety)	Ovule Parent (Variety)	Crosses Attempted	Fruits Formed	
			No.	Percent
flor x *uve*	*uve*	39	6	15
flor x *uve*	*flor*	100	35	35
flor x *uve*	*flor*^{B}	84	64	76
		Total 223	105	47
dens x *uve*	*uve*	7	3	43
dens x *uve*	*dens*	59	25	42
uve x *dens*	*dens*	25	15	60
		Total 91	43	47
		Total 314	148	47
dens x *uve*	*dens* x *uve*	22	10	45
uve x *dens*	*dens* x *uve*	7	3	43
dens x *uve*	*uve* x *dens*	28	5	18
		Total 57	18	32
flor^B x *uve*	*flor*^{B} x *uve*	25	11	44
flor^B x *uve*	*uve* x *flor*^{B}	41	28	68
uve x flor^B	*uve* x *flor*^{B}	8	7	88
uve x *flor*^{B}	flor^B x uve	39	26	67
		Total 113	72	64
		Total 170	90	53

ent (Table 2) show substantially higher percentages of fruits formed when *floridana* from Bermuda was the ovule parent than was obtained by employing its United States counterpart as the ovule parent. This is in agreement with data from the corresponding crosses in Table 1, again pointing up the unique genotype of the *floridana* plant from the United States.

The percentages of fruits formed from crosses involving F_1 plants (Table 2) are sufficiently high that only slight reduction in fertility, if any, is indicated for the second generation. The F_2 seeds germinated readily but more than half of them did not flower. A suggestion of genetic incompatability due to excessive homogeneity is obtained via 6 albino seedlings which appeared in the F_2 generation. These 6 seedlings resulted from crosses involving all varieties.

What then is the mode of inheritance of the varietal char-



Pl. 1413. Peduncle vestiture variation from the same plant. A = var. *uvedalia* while B lies between vars. *floridana* and *densipilis*.

acters? An examination of the data in Table 3 shows that offspring may resemble either parent or may be "intermediate." It is well to keep in mind that more than one category of intermediacy may obtain but a detailed pubescence measurement per unit area not only would be impractical but meaningless because peduncle vestiture may vary altitudinally on the same plant. For purposes of this study I arbitrarily used the uppermost 1 cm of peduncle vestiture to characterize each plant. Pilose hairs may be longer or shorter in offspring than in parents. Glandular hairs vary likewise but independently. Although plants in culture for 6 years have maintained their varietal integrity, the photographs below are of two "good" varieties from different peduncles of the *same* plant (Pl. 1413). The Fig. A would key out to var. *uvedalia*, while B lies between var. *densipilis* and *floridana*. Other similar cases were observed.

Thus, although some genetic basis for varietal traits is adequately demonstrated (Table 3) there is likewise evidence for environmental influences upon phenotypic expression. One might also hypothesize highly mutable gene(s)

Table 3. PHENOTYPES OF F_1, F_2, AND BACKCROSS PLANTS.

Pollen Parent (Variety)	Ovule Parent (Variety)	Peduncle Vestiture Type			Total
		Like Pollen Parent	Intermediate	Like Ovule Parent	
flor^B	*uve*	0	7	1	8
uve	*flor*^{B}	3	2	1	6
flor	*uve*	3	3	2	8
uve	*flor*	0	1	2	3
uve	*dens*	1	2	0	3
dens	*uve*	0	2	11	13
uve x *flor*^{B}	*uve* x *flor*^{B}	0	1	0	1
dens x *uve*	*dens* x *uve*	0	1	0	1
uve x *flor*^{B}	*flor*^{B} x*uve*	2 like var. *uve*	6	0	8
flor^B x *uve*	*flor*^{B} x *uve*	0	1	0	1
flor^B x *uve*	*uve* x *flor*^{B}	1	1	0	2
flor^B x *uve*	*flor*^{B}	0	13	0	13

causing such a phenotypic aggregation. With respect to *P. uvedalia* Blake (1917) points out that "On the Bermuda Islands . . . it is certainly introduced and seems to be rapidly naturalizing itself. The plant is not noticed in Reade's list of Bermuda plants (1883), and as it is unlikely that so conspicuous a plant could have escaped his notice, it seems very probable that it is a recent introduction." Owing to the tendency for individual varietal distributions to occur in different parts of the United States it is unlikely that more than one variety was originally introduced there although all three are recorded from there now. The var. *floridana* is a likely candidate for the species' first establishment since its range of distribution includes portions of the United States closest to Bermuda. (North Carolina is some 568 miles distant.) Moreover, this variety is approximately 20% self-fertile, which is the highest incidence reported (Wells 1966) among the three varieties. Outbreeding from a single var. *floridana* introduction could have produced the present range of phenotypes.

Future comments upon peduncle vestiture in *P. uvedalia* must take into account the following facts:

1) Two types of pubescence obtain; namely, stipitate glandular hairs and pilose hairs.
2) The two hair types appear to vary independently in size and in frequency.
3) Results from some crosses suggest a quantitative inheritance of peduncle vestiture although other crosses indicate a simple dominant-recessive relationship.
4) Individual peduncle vestiture often varies from the proximal to distal regions.
5) Environmentally induced variation is possible as indicated by the different vestiture types "varieties" observed on peduncles of the same plant.

In view of all the facts, little usefulness is realized in continued recognition of the three varieties of *P. uvedalia* according to Blake (1917). What is true for *P. uvedalia* likewise probably holds for the closely related *P. maculata* from Mexico and Central America which Blake treated similarly.

CRANBROOK INSTITUTE OF SCIENCE
BLOOMFIELD HILLS, MICHIGAN 48013

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